CAREER: Polymeric Optical Band Gap Composites - A Study of Multifunctional Photonic Materials

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DMR-0236692

•The objective of this work is to develop all-polymeric synthetic opals and exploit their potential multifunctional characteristics in prototype photonic devices.

• We are taking two coupled approaches to developing synthetic opals. One approach focuses on the synthetic fabrication of core-shell colloidal particles. The underlying cores are typically silica or polystyrene monodispersed particles which are coated with various materials, for example poly(3,4-ethylenedioxythiophene) (cf. Fig. 1), which impart a tunable component to the particles. The second approach focuses on utilizing the core-shell particle produced in the group and allowing these systems to self-assemble into dielectric structures with long range order. These systems often exhibit opalescence that can be spatially and spectrally tuned to create unique synthetic opals (cf. Fig. 2)

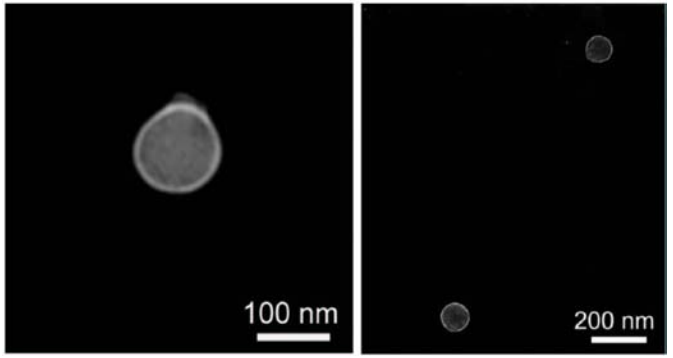

Fig. 1 Transmission electron micrographs of poly(3,4-ethylenedioxythiophene) coated 105 nm polystyrene particles.

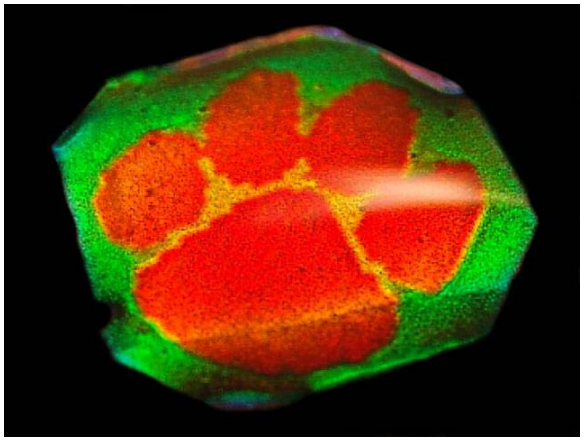

Fig. 2 A synthetic opal that has been templated with a Clemson University tiger paw.

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Education:
This work involves the collaboration of two graduate students (Jiqiang Xia and Ping Jiang), and visiting scholar (Moon Gyu Han). This past summer, our research group also hosted a six week research internships for a high school student (Brigham Dallas from South Carolina).

Outreach:
Many bright South Carolina students, capable of succeeding in college, don't always make it to the world of higher education. The reasons vary from financial obligations, lack of motivation, or to just not knowing college is a real possibility. Clemson University aims to change that through their Emerging Scholars Partnership Program.

The program focuses primarily on students from three South Carolina counties that rank near the bottom of the list in per capita income. Nearly 50 rising high school juniors and seniors took their first step toward a college education in the summer of 2004. The PI organized and taught a science module for the program during the summer of 2004 to provide the experience and mentorship to help the students to prepare for college.

The PI oversees a polymer laboratory for the Emerging Scholars Program.